

## Indiana University – Purdue University Fort Wayne Opus: Research & Creativity at IPFW

---

Computer and Electrical Engineering Technology &  
Information Systems and Technology Senior Design  
Projects

School of Engineering, Technology and Computer  
Science Design Projects

---

4-28-2010

# Simulation and Monitoring of a Photovoltaic Power System via LabVIEW and SQL database

Derek D. Krill

*Indiana University - Purdue University Fort Wayne*

Follow this and additional works at: [http://opus.ipfw.edu/etcs\\_seniorproj](http://opus.ipfw.edu/etcs_seniorproj)



Part of the [Computer Sciences Commons](#), and the [Engineering Commons](#)

---

### Opus Citation

Derek D. Krill (2010). Simulation and Monitoring of a Photovoltaic Power System via LabVIEW and SQL database.  
[http://opus.ipfw.edu/etcs\\_seniorproj/892](http://opus.ipfw.edu/etcs_seniorproj/892)

This Senior Design Project is brought to you for free and open access by the School of Engineering, Technology and Computer Science Design Projects at Opus: Research & Creativity at IPFW. It has been accepted for inclusion in Computer and Electrical Engineering Technology & Information Systems and Technology Senior Design Projects by an authorized administrator of Opus: Research & Creativity at IPFW. For more information, please contact [admin@lib.ipfw.edu](mailto:admin@lib.ipfw.edu).

INDIANA-PURDUE UNIVSERISTY FORT WAYNE

# Simulation and Monitoring of a Photovoltaic Power System via LabVIEW and SQL database

## Final Project Report

04/28/2010

Submitted by:  
Derek D. Krill

To fulfill:  
B.S Computer Engineering Technology Degree Requirement

Professor names:  
Paul I. Lin – CPET 491  
Curtis Crisler – ENG W421

Submitted to:  
Paul I. Lin, Professor of ECET 491 Senior Design II

Department of Electrical and Computer Engineering Technology  
College of Engineering, Technology, and Computer Science  
Indiana University-Purdue University Fort Wayne, Indiana

## **Abstract**

This paper presents the results of a project in which a system was programmed in National Instruments LabVIEW for the purpose of simulation and monitoring of a photovoltaic power system. For simulation, it uses a generalized photovoltaic model which was modified to be representative of the solar conditions near Fort Wayne, Indiana. Portions of the project could easily be implemented for other LabVIEW applications which could involve, but are not limited to, solar power simulation, power monitoring systems, and various other applications in which communication with a SQL database is desired.

## Table of Contents

LIST OF FIGURES	4
LIST OF TABLES	5
EXECUTIVE SUMMARY	6
CHAPTER 1. INTRODUCTION	7
<i>Background</i>	7
<i>Problem Topic</i>	7
<i>Methodology</i>	7
CHAPTER 2. SYSTEM DESIGN OVERVIEW AND RESEARCH	8
<i>Design Process</i>	8
<i>Legal Aspects</i>	13
<i>System Scope</i>	13
CHAPTER 3. SOFTWARE DESIGN	14
<i>Programming Language</i>	14
<i>Main Components</i>	14
<i>UML Diagrams: State Diagrams, Activity Diagrams, etc</i>	16
CHAPTER 4. UNIT TESTING AND SYSTEM INTEGRATION	18
CHAPTER 5. PROJECT MANAGEMENT	22
<i>Schedule and Time Management</i>	22
<i>Risk Management</i>	23
<i>Lessons Learned</i>	23
CHAPTER 6. CONCLUSION	24
References	25
APPENDICES	26
Appendix A – VI code	26

**List of Figures**

#	Description	Page
1	Regression analysis with Minitab	10
2	Insolation curve for a sample day and total insolation	11
3	Contour plots of insolation incidence throughout the year	12
4	VI hierarchy for simulation application	14
5	VI hierarchy for monitoring application	15
6	Flowchart of the simulation application	16
7	Flowchart of the monitoring application	17
8	Simulation software version 1	18
9	Monitoring software version 1	19
10	HeidiSQL showing data in SQL database	19
11	Simulation software version 2	20
12	Monitoring software version 2	21
13	Original proposed schedule	22
14	How the schedule played out	22
15	VI code for MonitorV2.vi (part 1)	26
16	VI code for MonitorV2.vi (part 2)	27
17	VI code for Simulator.vi (part 1)	28
18	VI code for Simulator.vi (part 2)	29
19	VI code for TestConnection(SubVI).vi	30
20	VI code for convert_string_to_timestamp.vi	30
21	VI code for LambdaT(SubVI).vi	31
22	VI code for ReadStructure(SubVI).vi	31
23	VI code for ReadSQL(SubVI).vi	32
24	VI code for WriteStructure(SubVI).vi	32
25	VI code for WriteSQL(SubVI).vi	33

## List of Tables

#	Description	Page
1	Equations used for the modeling of solar cell power data	8
2	Monthly Averaged Insolation Incident On A Horizontal Surface (kWh/m <sup>2</sup> /day)	8
3	Monthly Averaged Solar Noon (GMT time)	9
4	Monthly Averaged Insolation Incident On A Horizontal Surface At Indicated GMT Times (kW/m <sup>2</sup> )	9
5	Risk and probability assessment	18